

THE INVENTION CLAIMED IS

1. Apparatus for drilling holes in a material comprising,
a laser system that produces
a first laser beam for rapidly removing the bulk of material in an
5 area to form a ragged hole, and
a second laser beam for accurately cleaning up said ragged hole
so that the final hole has dimensions of high precision.
2. The apparatus of claim 1 wherein said first laser beam is an
infra-red laser beam.
- 10 3. The apparatus of claim 1 wherein said second laser beam is a
low power, short wavelength laser beam.
4. The apparatus of claim 1 wherein said first laser beam is an
infra-red laser beam and said second laser beam is a low power, short
wavelength laser beam.
- 15 5. The apparatus of claim 1 wherein said laser system has an
ablative mode for producing said first laser beam for rapidly removing the bulk
of material in an area to form a ragged hole.
6. The apparatus of claim 1 wherein said laser system has a trepanning
mode for producing said second laser beam for accurately cleaning up said ragged
20 hole so that the final hole has dimensions of high precision.
7. The apparatus of claim 1 wherein said laser system has an

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ablative mode for producing said first laser beam for rapidly removing the bulk of material in an area to form a ragged hole and a trepanning mode for producing said second laser beam for accurately cleaning up said ragged hole so that the final hole has dimensions of high precision.

5 8. The apparatus of claim 1 wherein said laser system comprises a single laser that produces said first laser beam and said second laser beam.

9. The apparatus of claim 1 wherein said laser system comprises a first laser that produces said first laser beam and a second laser that produces said second laser beam.

10 10. The apparatus of claim 1 wherein said laser system includes controls adapted to control first laser beam for rapidly removing the bulk of material in an area to form a ragged hole so that the final hole does not extend entirely through said material.

11. The apparatus of claim 10 wherein said controls are adapted to control first laser beam so that the final hole does not extend entirely through said material and said first laser beam leaves a thin membrane at the bottom of said hole.

12. The apparatus of claim 11 wherein said second laser beam breaks through said thin membrane at the bottom of said hole.

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13. A method of drilling a hole in a material comprising, the steps of:
generating a first laser beam,
directing said first laser beam at the material to remove the bulk
of the material to form a ragged hole and begin forming a final hole,
generating a second laser beam, and
directing said second laser beam at said hole being formed for
accurately cleaning up said ragged hole so that said final hole has dimensions of
high precision

14. The method of claim 13 wherein said
10 first laser beam is an infra-red laser beam.

15. The method of claim 13 wherein said
second laser beam is a low power, short wavelength laser beam.

16. The method of claim 14 wherein said infra-red laser beam is
produced by a laser operated in the ablative mode.

17. The method of claim 15 wherein said low power, short
wavelength laser beam is produced by a laser operated in the trepanning mode.

18. The method of claim 13 wherein said
first laser beam is an infra-red laser beam and said second laser beam is a low
power, short wavelength laser beam.

20 19. The method of claim 13 wherein said
second laser beam is focused to a spot much smaller than the diameter of said
ragged hole and said second laser beam is traced around the said ragged hole a

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~~multiplicity of times until there is little ragged material on the sides of said ragged hole.~~

5 20. The method of drilling a hole in a material of claim 19 wherein said second laser beam laser is used to polish the sides of said hole to obtain high dimensional precision.

21. The method of drilling a hole in a material of claim 13 wherein said first laser beam is produced by a first laser and said second laser beam is produced by a second laser.

10 22. The method of drilling a hole in a material of claim 13 wherein said first laser beam and said second laser beam are produced by a single laser.

23. The method of drilling a hole in a material of claim 13 including controlling said first laser beam for rapidly removing the bulk of material in an area to form a ragged hole so that the final hole does not extend entirely through said material.

15 24. The method of drilling a hole in a material of claim 23 including controlling said first laser beam so that the final hole does not extend entirely through said material and said first laser beam leaves a thin membrane at the bottom of said hole.

20 25. The method of drilling a hole in a material of claim 24 including controlling said second laser beam so that said second laser beam breaks through said thin membrane at the bottom of said hole.

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26. A piece with a hole therein produced by the method of:
generating a first laser beam,
directing said first laser beam at said piece to remove the bulk
of material in an area to form a ragged hole and begin forming said hole,
generating a second laser beam, and
directing said second laser beam at said hole being formed for
accurately cleaning up said ragged hole so that said hole has dimensions of high
precision.

27. The piece with a hole therein of claim 26 wherein said first laser beam is an infra-red laser beam.

28. The piece with a hole therein of claim 26 wherein said second laser beam is a low power, short wavelength laser beam.

29. The piece with a hole therein of claim 27 wherein said infra-red laser beam is produced by a laser operated in the ablative mode.

30. The piece with a hole therein of claim 28 wherein said low power, short wavelength laser beam is produced by a laser operated in the trepanning mode.

31. The piece with a hole therein of claim 26 wherein said first laser beam is an infra-red laser beam and said second laser beam is a low power, short wavelength laser beam.

32. The piece with a hole therein of claim 26 including the step of

controlling said first laser beam for rapidly removing the bulk of material in an area to form a ragged hole so that the final hole does not extend entirely through said material.

33. The piece with a hole therein of claim 32 including the step of
5 controlling said first laser beam so that the final hole does not extend entirely through said material and said first laser beam leaves a thin membrane at the bottom of said hole.

34. The method of drilling a hole in a material of claim 33 including the
step of controlling said second laser beam so that said second laser beam breaks
10 through said thin membrane at the bottom of said hole.

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